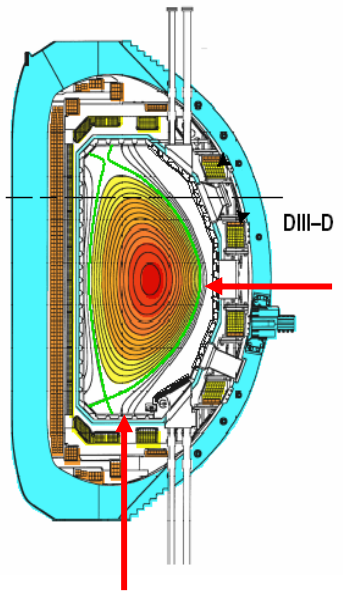
Mid-plane DiMES Proposal

Combine with Fast Probe Modification

- most suitable combination of probes, covering divertor and FW
- much lower cost than mid-plane DiMES alone proposal
- right timing for programmatic and manpower support
- will provide significant data to ITER and advanced tokamaks

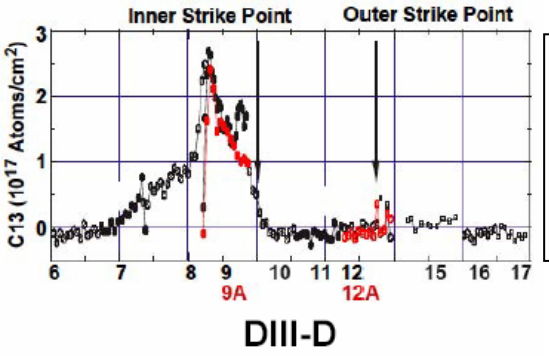
Clement Wong and Dmitry Rudakov
DiMES Team and DIII-D

PFC meeting, Dec. 6-9, 2004, Livermore, CA



DIII-D Boundary Experiments Supplement DiMES PMI Research

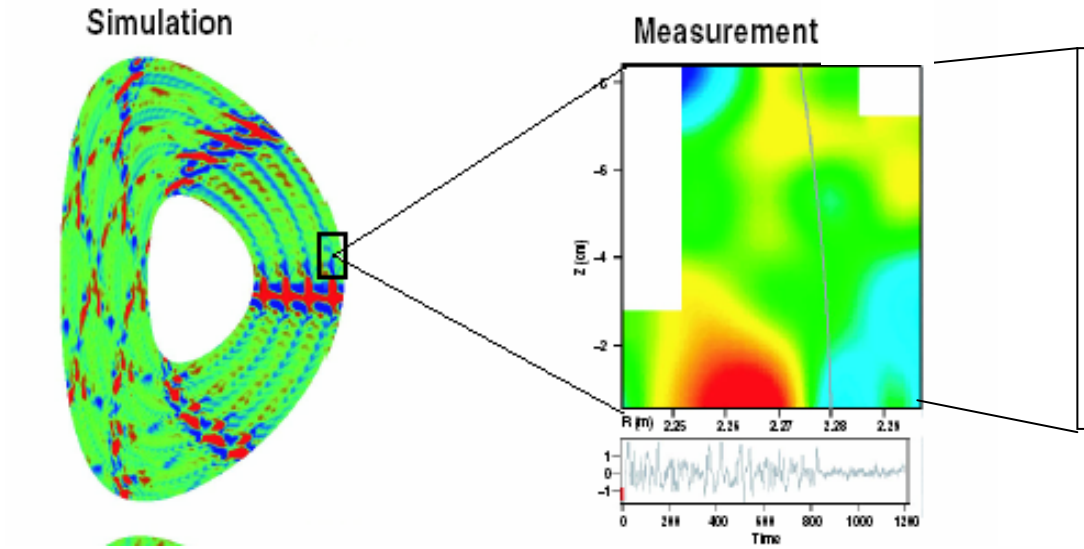
^{13}C Co-deposition Experiment Indicates Importance of Main Chamber Carbon Source



- **DiMES has provided significant information on divertor materials erosion/redeposition, and deuterium uptake…etc.**
- **DiMES has also confirmed uncertainties on chamber wall: erosion and transport of impurities from the first wall.**

Intermittent radial convection significant to chamber wall material erosion, e.g. Be for ITER

Beam Emission Spectroscopy Edge Turbulence Imaging Shows Plasma Blobs Propagate Radially



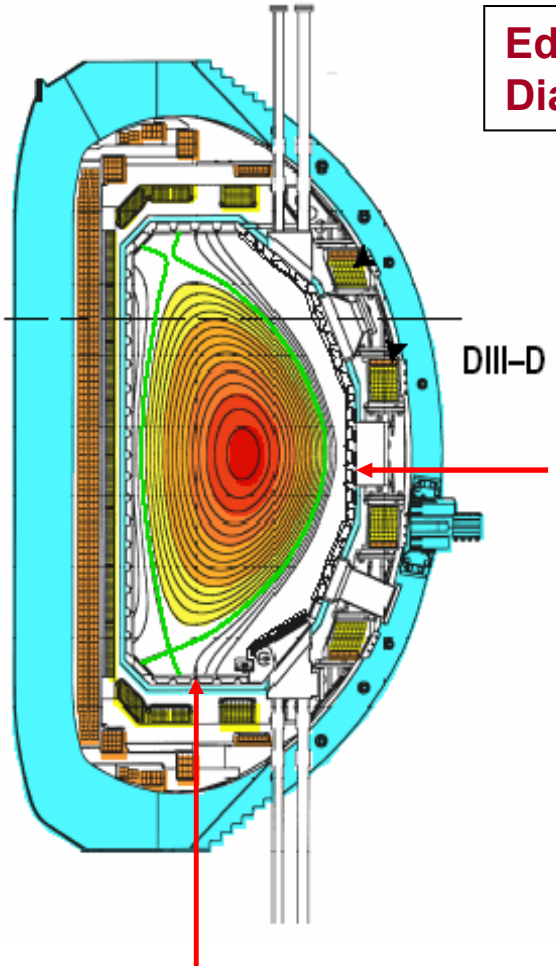
Mid-plane DiMES + fast probe will provide PSI measured data to bench mark modeling.

We already have an experienced DiMES Team: SNLs, ANL, UCSD, UCLA, DIII-D

ELMs can result in high transient fluxes of particles and heat to the outboard wall.

Combined Mid-plane DiMES and Fast Probe Modification Proposals

Divertor Materials:
Erosion/redeposition
Deuterium deposition
Impurities transport
Modeling…etc.



Lower Divertor DiMES

Edge physics:
Diagnostics, density temperature

Mid Plane Fast Probe

Proposal:
Combined DiMES and Fast Probe at ~ mid-plane

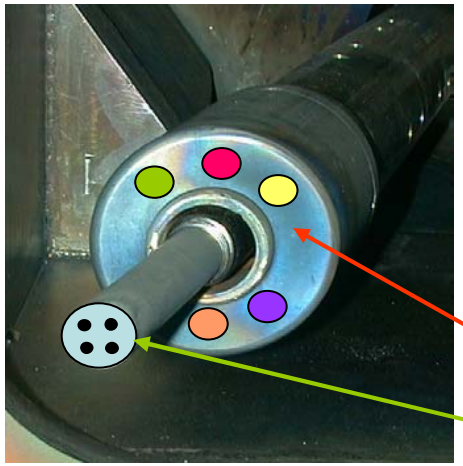
FYI: There is another fast probe toroidally displaced from divertor DiMES

Conversion Tasks and Budget

Modify and add airlock and sample exchange window, similar to DiMES, ~ $30k

Improve data acquisition system, ~$10 k

Modify inner drive tube, ~$10 k



Build DiMES-like changeable sample holders of two different types , ~$20k

Design and engineering ~$50k,

Samples can be placed:

- on the outer shield (retains plunging probe capability)
- on the plunging head (allows instrumented samples)

Total $120K: Requesting $100k from PFC program and $20k from probe program

Physicists time available due to DIII-D shut-down in 2005

Advantages for the Combined System

Why do it in 2005?

- The fast probe system already has an allocated port near the mid-plane (it is usually extremely difficult to find available port for new system in DIII-D). Driving mechanism exists and is proven.
- The data acquisition, power supplies and isolation amplifiers can be shared; the new funds will allow us to upgrade the existing probe system.
- It will be much cheaper than a stand alone mid-plane DiMES, former proposal was ~$300k, now $100k requested from the PFC program.
- The airlock will provide us with an opportunity to quickly exchange probe/annular sample heads, just like DiMES.
- Mid-plane and Divertor DiMES will complement each other to provide relevant data to ITER.
- New funds will allow us to redesign the probe drive tube in order to add new capabilities.
- Dmitry Rudakov is already involved in both systems, significant benefit on necessary coordination.
- DIII-D will have major modification from April 2005 to March 2006, physicists and engineers will be available to our proposal.